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DIRECTIONS FOR THE DISSECTION OF THE CAT

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DIRECTIONS FOR THE DISSECTION OF THE CAT

BY

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PREFACE

In its essential features the body of the cat is very similar to the human body. This fact, together with the abundance of the material and the convenient size of the animal; makes the study of the anatomy of the cat a desirable prerequisite for college courses in human physiology and personal hygiene and a valuable part of a system of premedical education.

The following directions are written from this point of view. The aim is to guide the student so that he may obtain by direct observation a clear vision of the organism as a whole, not as a series of isolated systems of organs.

For this reason the program of dissection is arranged so that it may be carried out on a single specimen. This has the additional advantage of economy of material, which is important where preparation must be made for large classes. Success in observation will depend in large measure on care in following exactly the directions for procedure, which form the important part of this book. For descriptive anatomy the student is referred to the standard textbooks of human and comparative anatomy, especially to the ''Anatomy of the Cat'' by Reighard and Jennings.

R. P. B.

Cambridge, Mass.
September, 1925.

CONTENTS

PAGE

INTRODUCTION ix

CHAPTER

I. SKELETON 1

II. EXTERNAL FEATURES 4

III. MUSCLES OF THORAX AND ABDOMEN 6

IV. ABDOMINAL VISCERA 9

V. SYMPATHETIC NERVOUS SYSTEM—
Abdominal Portion 11

VI. PORTAL SYSTEM AND VISCERAL ARTERIES 14

VII. DIGESTIVE TUBE 15

VIII. UROGENITAL SYSTEM 16

Female reproductive organs 17

Male reproductive organs 19

IX. THE VENA CAVA INFERIOR AND ITS BRANCHES . .. 21

X. ABDOMINAL AORTA AND ITS BRANCHES 22

XI. THORACIC VISCERA 23

XII. THE VAGUS AND THE THORACIC SYMPATHETIC NERVES 25

XIII. SUPERIOR VENA CAVA AND ITS BRANCHES 27

XIV. THORACIC AORTA AND ITS BRANCHES 29

XV. THE HEART 30

XVI. SALIVARY GLANDS 31

XVII. ARTERIES OF THE HEAD AND NECK 32

XVIII. MOUTH AND PHARYNX 33

XIX. RESPIRATORY ORGANS 34

XX. THE SPINAL NERVES 35

XXI. THE EYE 37

XXII. THE SPINAL CORD 39

XXIII. THE BRAIN 40

INTRODUCTION

Material for dissection may be prepared as follows: The animal, having been killed by chloroform or other convenient means, should be injected with the following embalming fluid,—

Borax	5 grams
Water	800 c.c.
Glycerine	160 c.c.
Formaldehyde (40 per cent. sol.)	40 c.c.

From 300 to 500 c.c. of this fluid will be required for each body. The embalming is accomplished best by allowing the fluid to flow through a cannula tied into the left femoral artery and connected by rubber and glass tubing to a pressure bottle placed four or five feet above the specimen. It is desirable to use as large a cannula as can be introduced into the artery. Before insertion, a piece of soft rubber tubing about 10 cm. long should be attached to the cannula, filled with fluid, and clamped with an artery forceps.

If the metal cannulæ manufactured by the Harvard Apparatus Company are used, the ends of the ligature threads [1] should be passed, after the cannula has been tied in place, in opposite directions behind the artery and tied together again in front close to the first knot. This second loop, if firmly tied, will usually prevent the cannula from being forced out of the artery by the back pressure. If the animal has been freshly killed, it may be well to fill the cannula with a 30 per cent. solution of magnesium sulphate to prevent clotting of the blood.

---

[1] Black cotton No. 50 makes good ligatures.

After the body has been embalmed, the blood vessels should be injected with a colored starch mass. This is composed of,—

Laundry starch	85 grams
Water	100 c.c.
Glycerine	20 c.c.
Formaldehyde (40 per cent.)	20 c.c.

The suspension of starch in water must be freed from all coarse particles by being passed through a fine wire strainer or gauze folded several times. Then add the glycerine and formaldehyde. To produce a red color, add one or two grams of powdered carmine and a few drops of ammonia rubbed together to form a paste. For a blue color add one or two grams of soluble Prussian blue. About 50 c.c. of the red mass will be needed for the arteries and a little more of the blue for the veins. A smaller amount of the uncolored mass may be reserved for the portal veins.

The best instrument to use is the ordinary brass syringe[1] for injections with a capacity of about 60 c.c. Its nozzle will fit into the short piece of rubber tube attached to the cannula.

The arteries may be injected most conveniently through the cannula that has been tied into the femoral artery. For the veins the cannula may be tied into the left femoral vein or into the right external jugular. The latter position has the advantage of lessening the risk of rupture of the delicate veins in the abdominal cavity.

Very beautiful injections may be obtained if the cannulæ are inserted in the living animal under ether anæsthesia, the clamp removed from the venous cannula, and the animal allowed to bleed to death while under the anæsthetic. But injection without bleeding gives sufficiently good results.

The prepared specimen should be kept wrapped in oiled cloth ("slicker cloth") with the glazed side next to the body. During dissection the skin should not be removed from the body and should be kept as intact as possible. After each exercise all cut surfaces must be bathed thoroughly with the embalming fluid, and the flaps of skin returned to their natural positions and tied in place.

---

[1] Made by Collin, Paris, France.

If the body has to be kept without attention for a week or more, or if danger threatens from drying or from mold, it should be immersed in a three per cent. solution of phenol:—

Phenol pure crystals	30 grams
Water	1000 c.c.

With these precautions carefully observed, the embalmed body may be kept in perfect condition until the dissection is completed. The time required is estimated to be about sixty laboratory hours.

DIRECTIONS FOR THE DISSECTION OF THE CAT

DIRECTIONS FOR DISSECTION OF THE CAT (Felis Domestica)

Books of Reference.

C = Cunningham, *Textbook of Anatomy,* Ed. 4, 1917.
W = Wilder, *History of the Human Body,* Ed. 2, 1924.
K = Kingsley, *Comparative Anatomy of Vertebrates,* Ed. 2, 1917.
R = Reighard and Jennings, *Anatomy of the Cat,* Ed. 2, 1901.
E = Ellenberger and Baum, *Anatomie des Hundes,* 1891.
S = Spalteholz, *Handatlas der Anatomie des Menschen,* 1898.
BNA = Barker, *Anatomical Terminology,* 1907.
P&H = Parker and Haswell, *Textbook of Zoology,* Ed. 2, 1910, Vol. 2.
D = Davison, *Mammalian Anatomy,* rev. by F. A. Stromsten.
T = Toldt, *Anatomischer Atlas,* Ed. 12 by F. Hochstetter, 1923.

I. SKELETON (Osteology)

[**R.** 1-92; **K.** 41-129; **W.** 124-216; **C.** 81-298; **S.** Vol. 1; Walter, *The Human Skeleton,* 1918.]

Mounted Skeleton

Note division into

1. Axial skeleton consisting of—
    a. skull.
    b. vertebral column.
    c. ribs.
    d. sternum.
2. Appendicular skeleton.
    a. shoulder girdle, or pectoral arch.

b. fore limbs.
c. pelvic girdle.
d. hind limbs.

Note the general arrangement of the bones in each part, including curves and angles, points of attachment, articular surfaces where visible, and consider how these features may be adaptive. Compare human skeleton.

3. Divisions of the skull. [**R.** 21.]
    - Cranium, brain case.
    - Facial bones, enclosing the nasal cavity.
    - Visceral skeleton,—mandible, hyoid, ear-bones.
4. Division of the vertebral column. [**R.** 1.]
    - Cervical, neck.
    - Thoracic, chest.
    - Lumbar, loin.
    - Sacral, attached to the Pelvis.
    - Caudal, tail.
    - How many vertebrae in each division, how distinguished, and what other bones are attached to them?
5. Ribs. (Costae) [**R.** 18-19].
    - How many?
    - Articulations with vertebrae.
    - Articulations with sternum.
    - Are the ribs all alike, if not how do they differ?
    - Of what tissues are they composed?
6. Sternum. [**R.** 20; **W.** 140-143.]
    - Manubrium. (anterior)
    - Corpus, how many segments and how related to the ribs?
    - Xiphoid process.

Compared with human sternum, which is the more primitive? [**C.** 108, fig. 122.]

7. Shoulder girdle. [**R.** 62; **K.** 114-118.]
   - Scapula. (shoulder blade)
     - Articular surface = glenoid fossa.
     - Coracoid process.
     - Spine of the scapula.
     - Acromion.
     - Vertebral border.
   - Clavicle. (collar bone)
     - Compare human clavicle.
8. Fore limb.
   - Humerus, upper arm bone.
   - Radius and ulna, fore arm bones.
   - Carpus, wrist, how many bones and how arranged?
   - Metacarpus, palm, how many bones?
   - Phalanges digitorum manus, finger bones.
9. Pelvic girdle, Pelvis. [**R.** 76; **K.** 118-123.]
   - Foramen obturatum.
   - Articular surface = acetabulum.
   - Three divisions of Innominate bone:
     - Ilium articulates with Sacrum.
       - Crest of the ilium.
     - Pubis unites with its fellow of the opposite side in the Symphysis pubis.
     - Ischium posterior to Obturator foramen.
10. Hind limb.
    - Femur, thigh bone.
    - Patella, knee cap.
    - Tibia and Fibula, leg bones.
    - Tarsus, how many bones and how arranged?
      - Note especially the ankle bone = Talus, or Astragalus.

Heel bone = Calcaneus.
Metatarsus, how many bones?
Phalanges digitorum pedis.

DISARTICULATED SKELETON.

If you have sufficient time, **draw** views of the skull proper as seen from above, below, behind, and at the side. With the aid of **R.** 49-62 find the name of each bone, suture, and foramen and label your drawings.

Draw the Mandible and label the **parts.**

Determine the dental formula of the cat. [**K.** 229-230; **W.** 305-309; **P&H.** 557-570.]

Study and **draw** the following:

- The hyoid bone.
- The 1st, 2nd, and 7th cervical vertebrae.
- A thoracic, a lumbar, and a caudal vertebra.
- The sacrum.
- A typical rib (1st to 10th).
- The sternum.
- Bones of the appendages and their girdles.

II. EXTERNAL FEATURES

Observe:

Hair, its arrangement. [**W.** 103-107.]
  Vibrissae, or whiskers.
  Color.
  Pattern.
Form of body, symmetry.
  Regions:
    1. Head.
      Mouth, lips.
      Nose, nostrils.
      Eyes.

Eyelids: upper. [**R.** 409.]
lower.
Nictitating membrane. [**R.** 410.]
Ears. [**R.** 415.]

2. Neck.
3. Trunk, subregions:
    - Thorax.
    - Abdomen and lumbar subregion,
        - Nipples.
    - Pelvic, or sacral, subregion,
        - Anus, separated by the
        - Perineum, from the
        - Urogenital orifice.
4. Tail.
5. Appendages:
    - Fore limbs:
        - Axilla = arm pit.
        - Upper arm = brachium.
        - Fore arm = antibrachium.
        - Elbow = cubitus.
        - Hand = manus.
        - Wrist = carpus.
        - Fingers = digits.
        - Claws.
    - Hind limbs:
        - Groin = inguen.
        - Thigh = femur.
        - Leg = crus.
        - Knee = genu.
        - Foot = pes, what part touches the ground?
        - Heel = hock = calx.
        - Toes = digits, how many?
        - Claws.

III. MUSCLES OF THORAX AND ABDOMEN

The animal having been killed, the body prepared as directed in the Introduction, and fastened in supine position upon the dissecting board:

Make a longitudinal incision through the *skin* extending along the midventral line from the anterior end of the sternum to the symphysis pubis. On the *right* side from each end of the first incision **make an incision** at right angles to it through the *skin* and extending to the shoulder and the groin respectively.

Separate the flap of the skin from the underlying structures on the right side only, dorsally nearly to the dorsal median line, taking care not to injure any structures in axilla and groin.

In the groin find and, if necessary, double ligate the superficial epigastric vein [**S.** 467] and cut it between ligatures.

(NOTE. If the subject is a female with well developed *mammæ*, leave these glands attached to the body, cutting around the nipples. **Draw.**)

Note the *superficial fascia* (sheet of connective tissue) containing *great cutaneous* muscle and fat. (This may come off with the skin.)

Remove all loose connective tissue, cutaneous muscle, mammae, if present, etc.

Observe Linea alba in the ventral median line.

To dissect a muscle:

1. Clean off all loose connective tissue and fat from its surface and note the direction of its fibres.
2. Find the edges of the muscle and separate it there from adjacent structures.

3. Lift up edge of muscle and with the seeker separate it from underlying structures.
4. When it becomes necessary to **remove** a muscle always cut first through the belly of the muscle at right angles to the course of its fibres and turn back the ends. These may be cut off later when necessary.

Note origin, insertion, action, and other relations of the following muscles:

1. Latissimus dorsi [**R.** 121], a broad sheet of muscle extending from the dorso-mid line to the humerus and covering the anterior-dorsal parts of the thorax and abdomen. **Do not try to find its insertion.**
2. Breast muscles [**R.** 109, 144], a thick mass of four muscles extending transversely from the sternum and connecting the arm and thorax:
   a. Pectoantibrachialis [**R.** 145], a small flat bundle, arising from the manubrium.
   b. Pectoralis major [**R.** 145].
      1. Superficial layer in front of *a*.
      Note the relation of this to a neck muscle the clavo-brachialis [**R.** 157], and **separate** the two.
      2. Deep portion under *a* and *b 1.*

   Cut *a and b,* and on the inner side of *b* find the branches of the thoracica longa artery and vein, also the second anterior thoracic nerve.

   c. Pectoralis minor [**R.** 146], a fan-shaped mass of fibres thicker than the Pectoralis major and partly covered by it.
   d. Xiphihumeralis [**R.** 147, figs. 65 & 68], a long thin muscle at the posterior edge of *c*.

   Cut *c and d.*

3. External oblique [**R.** 153, fig. 68, p. 117], a thin muscle covering the whole abdomen and part of the thorax. The fibres end in an aponeurosis (broad thin tendon) which forms part of the covering of the next (4).

   Cut the aponeurosis, being very careful not to cut into the underlying muscle. Find the insertion of the aponeurosis and the edge of the next muscle.
4. Rectus abdominis [**R.** 155, fig. 73, p. 149], a longitudinal muscle extending from the pubis to the 1st rib and separated from its fellow by the linea alba. Does it show evidence of segmentation?
5. Transversus costarum (sterno-costalis externus) [.**R** 150, fig. 73 *j*], a thin muscle covering the anterior end of the rectus abdominis.
6. Scalenus [**R.** 141, 149, fig. 73], Trace thoracic part only, which consists of three portions, dorsal, middle, and ventral, taking origin from the ribs and extending into the neck.

   Cut the middle part of 6.
7. Serratus anterior (serratus magnus) [**R.** 122, 149], continuous anteriorily with the levator scapulae [**R.** 123, fig. 73 *i* and *h*]. Find its origin and insertion.
8. Intercostal muscles [**R.** 150].
   a. External.
   b. Internal.
      What is the direction of the fibres in each?
9. Internal oblique [**R.** 154]. Note its extent and the direction of its fibres.

   Cut the aponeurosis of 9. What is the relation of this aponeurosis to the Rectus abdominis muscle?

10. Transversus abdominis [**R.** 155], the inner muscle of the abdominal wall.

IV. ABDOMINAL VISCERA

Dissect off a flap of skin from the left side of the body as previously done for the right side.

Make a longitudinal incision through the body-wall parallel to the linea alba a little to the *left* of the median line and extending from the xiphoid process to the symphysis pubis. From the middle of this incision make a short transverse cut on each side, and sponge out any liquid that may have accumulated in the body-cavity.

Observe:

Abdominal cavity.
Peritoneum [**R.** 218], parietal portion lining the body-wall.
Great omentum [**R.** 219].
Spleen, large brownish body on the left [**R.** 242].
Stomach.
Liver.
Urinary bladder.

Lift very gently the great omentum, taking great pains not to tear any part of it.

Lift the loop of intestine in the right anterior part of the abdomen, and in the duodenal mesentery **find** the Superior mesenteric vein.

Inject the Portal system with white starch through a cannula inserted in the superior mesenteric vein.

Examine the Great omentum, its

Structure.

Attachments.

Omental sac; compare human anatomy (The Foramen of Winslow is the opening of the omental sac, and may be seen later.)

Explore the abdominal cavity as thoroughly as possible *without* cutting or tearing anything, **observing**:

1. Urinary bladder. Vesica urinaria [**R.** 256].
    - a. Suspensory ligament of the bladder.
    - b. Lateral ligaments. (In the male a Vas deferens will be found here on each side.)

   Note attachments of *a* and *b* to the body-wall.

2. Large Intestine [**R.** 237].

   Its position and divisions, beginning at the posterior end:
    - a. Rectum.
    - b. Colon.
        - Descending.
        - Transverse.
        - Ascending.
    - c. Caecum.
        - How connected with the Small intestine?
        - Is there an Appendix vermiformis?

3. Small Intestine [**R.** 236].
    - a. Ileum.
    - b. Jejunum.
    - c. Duodenum.
        - Can you find boundaries between these parts?
        - Compare human anatomy.

4. Mesentery [**R.** 218]—notice its
    - a. Attachments to the intestines, to the body-wall, other attachments.
    - b. Blood vessels.

    - c. Lymph glands. The largest of these is called the "Pancreas of Asellius."
5. Spleen, Lien [**R.** 242], its size, form, position, and attachments.
6. Liver, Hepar. Details to be studied later.
7. Stomach [**R.** 234], its form and position:
    - a. Pylorus.
    - b. Greater curvature.
    - c. Lesser curvature.
    - d. Cardia.
    - e. Mesogaster.
    - f. Gastro-hepatic omentum.
8. Pancreas: [**R.** 241-2, figs. 102, 125], its lobes and their relations to the Duodenum and to the Stomach and Mesentery.
9. Diaphragm [**R.** 151], anterior to the Liver and the Stomach.
10. Kidneys, on each side, partly covered by Perirenal fat.

    Are they symmetrical?
11. Left Suprarenal body (Adrenal) [**R.** 257].

    The right Suprarenal is covered by a lobe of the liver.
12. Female reproductive organs:
    - a. Uterus.
    - b. Ovaries.
    - c. Broad ligaments.
    - d. Round ligaments.

V. SYMPATHETIC NERVOUS SYSTEM—ABDOMINAL PORTION

[**C.** 762, 764, figs. 640, 641. **R.** 406-8, fig. 164.]

Remove the Great Omentum, leaving a fringe of half an inch or more at the attachments. Be careful *not* to cut between the pancreas and the spleen or between the spleen and the stomach.

Lift the Duodenum and turn it with the rest of the Intestine to the left. Fasten it there with a hook. With the seeker, tease away the peritoneal layer of the Mesentery opposite the anterior end of the Kidney, so as to expose the

1. Superior mesenteric plexus [**R.** 408], lying upon the Superior Mesenteric Artery [**R.** 303].
2. A large Lymphatic vessel may be observed anterior to and parallel with the Artery.

   Carefully follow the nerves dorsally with the seeker to expose the
3. Right Coeliac ganglion [**R.** 406], being careful not to injure the Vena Cava [**R.** 325].

Turn the entire Intestine and the Stomach as far as possible to right, and fasten it there.

Find, without cutting anything,

Left kidney.
Left suprarenal body.
Greater curvature of the stomach.

Tease away the peritoneum carefully between the stomach and the left suprarenal body, and thus expose:

1. The left Coeliac ganglion (Semilunar ganglion [**R.** 406], lying upon the Superior mesenteric artery. Is it connected with the right ganglion?

   Compare position and form in the human body [**C.** figs. 638, 640, 641, pp. 758-65].
2. Great Splanchnic nerve. Trace this from the coeliac ganglion to where it enters the diaphragm.
3. Coeliac plexus (Solar plexus), fine nerves spreading from the ganglion in various direc-

tions. To what organs are you able to trace them?

Find in the posterior part of the Mesocolon [**R.** 219], the Inferior mesenteric artery [**R.** 306], and by teasing away the Peritoneum, the

4. Inferior mesenteric ganglion [**R.** 408], lying upon the Aorta near the origin of the artery.
5. Inferior mesenteric plexus. Any connection with the Coeliac plexus? With the Pelvic plexus?

Double ligate and **cut** the Adrenolumbalis artery and vein [**R.** 304, fig. 126], opposite the anterior pole of the kidney.

Cut through the peritoneum on the lateral side of the kidney, being careful not to cut the Ureter or any blood vessels. Turn the kidney to the right, and with the seeker tease away the loose connective tissue in the groove between the Aorta and the Psoas minor muscles [**R.** 139], by this action exposing the

6. Truncus sympathicus, of both sides.

   Trace the left trunk from the diaphragm posteriorly, taking care not to cut any nerves or blood vessels.

   a. Ganglia of the trunk.
   b. Branches from the ganglia.
7. Lesser splanchnic nerves, from the coeliac ganglion to the truncus sympathicus. How many? The first may enter the diaphragm. Trace it no further.

Draw an outline of the Cat and on it make a diagram of the part of the sympathetic system so far observed.

VI. PORTAL SYSTEM AND VISCERAL ARTERIES

Items in parentheses in this and following sections may be omitted.

Tease the peritoneum from the blood vessels in the mesenteries and **find**:

1. Portal vein [**R.** 326; **C.** 991, fig. 796].
2. Superior mesenteric vein and its Branches to the small intestine.
3. Gastrosplenic vein and its Branches.

(4. Vena pancreatoduodenalis [**R.** fig. 125] on the Duodenum).

(5. Vena gastroepiploica, on the greater curvature of the Stomach.)

(6. Vena coronaria ventriculi, from the lesser curvature.)

7. Inferior mesenteric vein, and its Branches to the Colon.

Draw a diagram of the Portal System.

Trace with the seeker:

1. Coeliac artery and its Branches [**R.** 301; **C.** 929, fig. 771].
    - a. Lienalis, or Splenic artery.
    - b. Gastrica sinistra [**R.** 303].
    - c. Hepatic artery [**R.** 302], seen best from the right.

The demonstration of *b* and *c* will be easier if a thread be tied around the coeliac artery near the first branch and the free end be passed out through the omental sac and held taut.

~~(d. Phrenic artery, to diaphragm, usually arises from the Adrenolumbalis.)~~

2. Superior mesenteric artery [**R.** 303; **C.** 931, fig. 772].

    - a. Pancreatic branches.
    - b. Intestinal branches.
  - 3. Inferior mesenteric artery [**R.** 306; **C.** 934, fig. 773].
    Branches. How distributed?

Draw a diagram of the Visceral Arteries.

VII. DIGESTIVE TUBE

Turn the entire intestine to the left, and fasten it there.

Trace with the seeker:

  1. Common bile duct from its position parallel to the portal vein in the margin of the lesser omentum bordering the foramen of Winslow to its entrance into the duodenum [**R.** 241].
  2. Branches of the common bile duct?
     - a. Cystic duct to the Gall bladder.
     - b. Bile ducts to the lobes of the liver.

Tease away the tissue of the Pancreas and find

  1. Pancreatic duct [**R.** 242]. Trace it to the duodenum.

  ~~(2. Accessory pancreatic duct.)~~

Remove the spleen.

Lift up the intestine and **cut** through the mesentery *close* to the intestine from the duodenum to the rectum, first ligating any vessels that may bleed. Doubly ligate the rectum in front of the bladder and the duodenum below the duct of the pancreas. **Cut** between the ligatures at each end, and **remove** the intestine.

Examine the intestine:

  1. Measure its length. 5 ft ½ in
  2. Slit open the duodenum, wash out the contents,

and examine the mucous membrane. Observe the villi. Are parasites present?

3. Slit open the caecum and adjacent parts of the ileum and colon. Find the ileocaecal valve. Are villi present in the ileum, in the colon? Peyer's patches?

Make a longitudinal incision along the greater curvature of the stomach from near its middle to the pylorus and continue it into the duodenum. Remove the contents of the stomach and duodenum.

Examine: Pylorus.
Mucous membrane of stomach.
Mucous membrane of duodenum.
In what ways do they differ?

Study the Liver, Hepar [**R.** 239-241].

1. Its relation to the peritoneum:
   - a. Serous coat.
   - b. Lesser omentum, gastro-hepatic.
   - c. Coronary ligament.
   - d. Falciform ligament.
2. Divisions of the liver:
   - a. Two main divisions separated by the falciform ligament and the umbilical notch.
   - (b. Lobes in each division, how many?)
3. Porta (door) of the liver. What vessels enter here?

VIII. UROGENITAL SYSTEM

Remove peritoneum and fat covering the left kidney, taking care not to open the Capsule of the kidney or to injure the vessels or the suprarenal body.

Observe the form of the Kidney [**R.** 255] (Ren, metanephros):

1. Lateral margin.

2. Medial margin.
3. Hilus.

Note the vessels entering the kidney at the hilus:

1. Renal artery.
2. Renal vein.
3. Ureter.

Trace with the seeker:

Ureter from the kidney to the bladder, taking care not to injure the vas deferens or blood vessels.

Open the Capsule of the kidney. With what is it continuous?

Slice away the ventral wall of the kidney to expose the

1. Sinus.
2. Papilla. Compare human anatomy.
3. Pelvis of the kidney. What is its form? Can you pass a bristle from it into the ureter?

Make a transverse section of the kidney, and observe:

1. Cortical layer.
2. Medullary substance.
3. Sinus. What is its form? V shaped

Study the urinary bladder:

1. Form and position.
2. Neck.
3. Suspensory and lateral ligaments.
4. Openings of the ureters.

   Make a longitudinal incision in the ventral wall of the bladder as far as the neck. Find the openings and pass bristles from the bladder into the ureters.

Draw an outline of the cat and add outlines of the organs of this system so far as observed.

Female Reproductive Organs [**R.** 263].

Find: Vulva.

Urogenital sinus.

Make a longitudinal incision through the skin from the symphysis pubis to within a quarter of an inch of the vulva. Make transverse cuts at the end of the incision and turn back the flaps. Remove the muscles from the ventral aspect of the pelvis on both sides so as to expose the Obturator foramen [**R.** 76]. With a strong scalpel cut through the symphysis. Grasp one of the legs firmly in each hand and bend them back sharply. Carefully separate the underlying structures from the pelvic bone. Then with the bone forceps cut through the narrow parts of the pubis and ischium, taking great care not to injure the organs within the pelvis.

Examine, without cutting any more:

1. Ovaries,—their position, form and size.
2. Oviducts:
    - a. Osteum tubae.
    - b. Fallopian tube.
    - c. Uterus [**R.** 266].
        - *1.* Cornua uteri (horns of the uterus).
        - *2.* Corpus uteri (body of the uterus).

        If the subject is pregnant, what is the position of the embryos? (Young embryos should be preserved carefully in 10 per cent formalin.)
    - d. Vagina.
3. Attachments of the uterus.
    - a. Broad ligament.
    - b. Round ligament.
    - c. Ligament of the ovary [**R.** 264].

Slit open one horn and the anterior part of the body of the uterus. Is the body of the uterus divided?

Pass a probe from the uterus into the vagina, and feel with the finger for the hard Cervix uteri.

Open the vagina on *one side,* taking care not to cut the cervix and examine:

Cervix uteri.
Os uteri.

Pass a probe through the neck of the bladder, and **observe:**

4. Urethra.
    a. Its external Orifice.
5. Urogenital sinus, or Vestibule.
6. Vulva.

Add these organs to the drawing of the urogenital system.

MALE REPRODUCTIVE ORGANS [**R.** 257].

Find: Penis.
Scrotum.

Make a longitudinal incision through the skin exactly on the median line from the symphysis pubis nearly to the dorsum of the penis. Carefully dissect the flap on one side only, so as to uncover the

Spermatic cord [**R.** 258]. Trace this to the scrotum.

Dissect carefully the skin from the scrotum, and observe on each side a

Tunica vaginalis, enclosing a
Testis. Note its connection with the Spermatic cord.

Open one tunica vaginalis, and **observe:**

1. Cavity of the scrotal sac, lined by the
2. Parietal layer of the Tunica vaginalis propria.
3. Visceral layer of the Tunica vaginalis propria covering the

4. Testis.

Make a longitudinal incision through the parietal layer of the tunica vaginalis propria, and reflect it from the testis. With the fine scissors continue the incision along the spermatic cord, taking great care not to injure the organs within, as far as the

1. Inguinal canal, and observe: the position and connections of:—
2. Testis.
3. Epididymis (mesonephros) [**R.** 260].
    - *a.* Caput epididymis.
    - *b.* Cauda epididymis.
4. Vas deferens.
5. Spermatic artery.
6. Spermatic vein.

Dissect the abdominal muscles from the inguinal canal, and without cutting anything more trace 4 to the neck of the bladder, and 5 and 6 to their sources.

Dissect the skin from the dorsum of the penis [**R.** 262].

Observe:

1. Prepuce (terminal fold of skin).
2. Glans penis.
3. External orifice of the urethra.
4. Crura of the penis, their attachment to the ischium.

Dissect the crura and the adjoining muscles from the ischium, and with a strong scalpel cut through the symphysis pubis. Take the legs, one in each hand, and bend them sharply backward. Dissect the muscles from one side of the pelvis so as to expose the obturator foramen, and with the bone forceps cut through the narrow parts of the ischium and the pubis, and remove these bones, taking care not to injure the pelvic organs.

Find: Urethra, trace it from the neck of the bladder to the penis.
Prostate gland [**R.** 261].
Vasa deferentia. Where do they enter the urethra?

Add these organs to your diagram of the urogenital system.

IX. THE VENA CAVA INFERIOR AND ITS BRANCHES

Clear away the peritoneum from the dorsal region of the abdomen, using the seeker and taking great care not to injure any arteries or spinal nerves.

Find:

1. Vena cava inferior [**R.** 325]. Trace it from the pelvis to the liver.
2. Its Branches:
    - a. Common iliac veins [**R.** 328].
        - *1.* Vena sacralis media [**R.** 328], continued as Caudal vein. Is it symmetrical?
        - *2.* Hypogastric, Internal iliac, vein [**R.** 329].
        - *3.* External iliac [**R.** 329].
            - (a) Vena femoralis, continuation of the External iliac in the leg.
            - (b) Vena profunda femoris [**R.** fig. 126].
            - (c) Superficial epigastric vein [**S.** 467], may be conspicuous in the female.
    - b. Iliolumbalis veins, from the lumbar muscles.

c. Lumbar veins, dorsal side, muscles of the back.

d. Spermatic (in the male).
   Ovarian (in the female).

Are these veins symmetrical?

e. Renal veins, their positions and relations to *d*.

f. Adrenolumbalis veins, from the suprarenal bodies and abdominal wall.

Trace the vena cava through the liver. First examine the anterior and posterior surfaces of the liver and then tease away the surface of the liver, and find:

g. Hepatic veins [**R.** 326]. How many?

h. Phrenic veins, in the diaphragm.

Draw, on an outline of the cat, the vena cava and its branches so far as observed, and indicate the organ in which each arises.

X. ABDOMINAL AORTA AND ITS BRANCHES

Dissect the left coeliac ganglion with the great splanchnic nerve away from the superior mesenteric artery, taking care not to cut the nerve, and turn the ganglion with the nerve to one side so as to expose the arteries.

Ligate the vena cava where it enters the liver and where it passes to the dorsum of the aorta, and remove the part of the vein between the ligatures, ligating and cutting the branches where necessary.

Find:

1. Aorta. Trace this artery from the diaphragm to the pelvis.

2. Its branches, beginning near the diaphragm [**R.** 301].
    a. Coeliac artery.
    b. Superior mesenteric artery.
    c. Adrenolumbalis [**R.** 304].
    d. Renal.
    e. Spermatic, in the male.
       Ovarian, in the female.
    f. Inferior mesenteric artery.
    g. Iliolumbalis [**R.** 306].
    h. Lumbar, from the dorsal side of the aorta to the muscles of the back. How many? Are they paired?
    i. External iliac [**R.** 307].
        1. Femoralis [**R.** 310], continuation of External iliac in the leg.
        2. Profunda femoris [**E.** fig. 148; **R.** 309-310], and its branch, Inferior epigastric, on the inner surface of the Rectus abdominis muscle [**S.** *2,* 407]. Is there a similar artery in the shark?
    j. Hypogastric (internal iliac) [**R.** 307]. What organ does this supply?
3. Caudal artery (*Arteria sacralis media*) [**R.** 309].

Draw an outline of the cat and represent the aorta and its branches so far as traced. Indicate the organ supplied by each artery.

XI. THORACIC VISCERA

Examine the

Diaphragm [**R.** 151].
    a. Tendinous portion (Semilunar tendon).

b. Muscular portion.
    1. Vertebral part, Crura.
    2. Sternocostal part.

Dissect the skin and muscles from the ventral part of the thorax on the left side so as to expose the sternum and the costal cartilages. With strong, round-pointed scissors make a longitudinal incision through the body-wall about *half an inch* from the median line on the left side of the sternum from the diaphragm through the first rib, being very careful not to cut anything in front of the first rib. Cut through the sternocostal part of the diaphragm on the left side close by the ribs to a point near where the great splanchnic nerve penetrates it. Enlarge the opening into the thorax by cutting with bone forceps through the ribs on the left side, working from the inside and taking great care when cutting the first rib not to injure adjacent parts. Do not cut the muscles, but turn the flap to the left and fasten it there with hooks.

Observe:

1. Thoracic cavity (left pleural sac) [**R.** 217].
2. Left lung, its lobes [**R.** 253]; its Hilus [**C.** fig. 870].
3. Pleura [**R.** 217].
    a. Parietal part covering ribs and diaphragm.
    b. Pulmonary part covering the lung.
    c. Mediastinal septum, dividing the thoracic cavity into right and left halves [**R.** 218].

Without cutting into the mediastinum, locate the position of:

4. Heart.
5. Oesophagus.
6. Aorta.

7. Phrenic nerve. Trace this from the root of the lung to the diaphragm [**R.** 388].

Open the right pleural sac by cutting through the body wall on the right side of the sternum, using the same procedure as for the left side. Do not cut the mediastinum.

Observe:

1. Right lung, its lobes [**R.** 252].
2. Inferior vena cava in a fold of the mediastinal pleura extending from the diaphragm to the heart.
3. Infracardiac space. This may be found by passing the finger around the dorsal side of the vena cava.
4. Right phrenic nerve. Trace it from the root of the lung to the diaphragm. Is its course the same as on the left side?

XII. THE VAGUS AND THE THORACIC SYMPATHETIC NERVES

Examine the inner side of the sternum and the anterior part of the Mediastinal septum, and find the Internal mammary arteries and veins. Thymus gland, if present.

Ligate these vessels near the sternum. **Cut** through the mediastinum close to the sternum, and remove the latter.

Turn the left lung forward or to the right, and fasten it there with hooks, so as to expose the dorsal part of the left pleural sac.

Trace:

1. Sympathetic nerve trunk from where observed in the abdomen to the

2. Inferior cervical ganglion, near the head of the first rib. The nerve trunk may be found by teasing away the pleura to the left of the aorta.
3. Great splanchnic nerve. Trace it from the Coeliac ganglion to the Sympathetic trunk.
(4. Lesser splanchnic nerves.)
(5. Thoracic ganglia. How many?)
(6. Rami communicantes. From thoracic ganglia to spinal nerves.)

Make a longitudinal incision through the skin on the mid-ventral line from the sternum to the larynx, taking great care not to injure the

7. Transverse vein [**R.** 321].

Reflect the skin on the left side of the neck, and find

8. External jugular vein [**R.** 319-320].

Dissect from their origins any of the Pectoral muscles that remain intact on the left side of the body.

Cut along the median line through the Sternomastoid muscle [**R.** 139], and between the Sternohyoid muscles [**R.** 140], and separate the muscles on the left side from the underlying structures. **Sever** the left Sternohyoid near its origin. **Cut** the Clavotrapezius muscle [**R.** 118], and **trace** the left External jugular vein to its junction with the

9. Left Subclavian vein [**R.** 318], to form the
10. Left Vena anonyma (Innominate vein) [**R.** 318].
(11. The entrance of the left branch of the Thoracic duct [**R.** 331-3] into the vein may be observed at this point.)

Observe:

12. Trachea. Its cartilaginous rings [**R.** 251-2].
13. Thyroid gland, its lateral lobes and isthmus [**R.** 254].

14. Left Common carotid artery [**R.** 282].
15. Left Vagus nerve, Xth Cranial [**R.** 378], closely bound with
16. Sympathetic nerve trunk.
17. Internal jugular vein [**R.** 320]. Trace the vein to its junction with the External jugular.

Double ligate and **cut** the Internal mammary artery [**R.** 292], and the Innominate vein where it lies over the left Carotid artery.

Trace the Sympathetic trunk posteriorly to the

18. Middle cervical ganglion [**R.** 405]. How is it connected with the Inferior cervical ganglion? (The Superior cervical ganglion will be seen later in connection with the Ganglion nodosum, No. 22.)

Cut through the diaphragm to the oesophagus, and trace

19. Left Vagus from the neck to the stomach. Branches? [**R.** 380-2].

Trace in the same way:

20. Right Vagus. Is this connected with the left vagus?
21. Right Sympathetic trunk.

Trace the united vagus and sympathetic trunks forward on one side to

22. Ganglion nodosum on the vagus [**R.** 378].
23. Superior cervical ganglion on the sympathetic [**R.** 404]. These may appear as one ganglion.

Add all of these nerves to the diagram of the sympathetic nervous system.

XIII. SUPERIOR VENA CAVA AND ITS BRANCHES

Tear away part of the mediastinal septum, and observe:

Contents of Mediastinal cavity.
  - a. Thymus gland [**R.** 254].
  - b. Pericardium. Inflate it. How it is attached to the heart? [**R.** 279-280]. Is it connected with the diaphragm? Compare human anatomy.

Remove the thymus gland and the pericardium without cutting any vessels.

Examine:

1. Heart [**R.** 274].
   - a. Auricles, right and left.
   - b. Ventricles, right and left.
2. Great blood vessels. Find where each one enters the heart.
   - a. Pulmonary artery [**R.** 280].
   - b. Aorta [**R.** 281].
   - c. Pulmonary veins [**R.** 315]. How many?
   - d. Inferior vena cava. Observe its course from the diaphragm to the heart.
   - e. Superior vena cava [**R.** 316].

Ligate the Inferior vena cava close to the diaphragm, **cut** it on the distal side of the ligature.

Remove diaphragm, liver, and stomach from the body.

Trace the branches of the Superior vena cava:

1. Azygos vein [**R.** 316]. Its branches:
   - a. Intercostal veins. Are they paired?
2. Sternal vein, dividing into right and left.
   - a. Internal mammary veins [**R.** 318].
3. Innominate veins [**R.** 318]. Trace the branches of the right innominate vein.
   - (a. Vertebral.)
   - (b. Costocervical, usually united with the vertebral.)
   - c. Subclavian [**R.** 318], which after passing

through the wall of the thorax becomes the

- *1.* Axillary vein [**R.** fig. 122], and divides into
- *2.* Subscapular and
- *3.* Brachial.

d. External jugular vein [**R.** 319]. Its branches:

- *1.* Internal jugular [**R.** 320].

(At this point may be found, if injected, the

- (a) Thoracic duct of the lymphatic system. It may be traced backward by carefully teasing away the pleura on the left side of the aorta, to the
- (b) Receptaculum chyli [**R.** 333]).

- *2.* Vena transversa scapulae [**R.** 320].
- *3.* Posterior facial vein [**R.** 321] and [**R.** 323].
- *4.* Anterior facial vein [**R.** 321].
- *5.* Vena transversa.

Add the superior vena cava and its branches to the diagram of the venous system.

XIV. THORACIC AORTA AND ITS BRANCHES

Trace: the Aorta [**R.** 281] from where it leaves the heart to the abdomen, and its branches:

1. Innominate artery [**R.** 282], giving off the
    - a. Mediastinal artery, and then dividing into
    - b. Left common carotid artery,
    - c. Right common carotid artery, and
    - d. Right subclavian artery [**R.** 282].
2. Left subclavian artery [**R.** 283].

3. Intercostal arteries. Are they paired? [**R.** 283].
4. Bronchial arteries to the lungs [**R.** 283].
5. Oesophageal arteries [**R.** 283].

Add these arteries to the diagram of the arterial system.

XV. THE HEART (Cor)

Cut the arteries and veins a short distance from the heart [**R.** 274], dissect carefully to free it from the lungs, leaving them in place, remove the heart from the body, and place it in a pan of water.

Clear away carefully all loose tissue adhering to the vessels.

Identify:

1. Great blood vessels entering the heart [**R.** 274]. *See* XIII 2.
2. Intrinsic vessels of the heart:
    a. Left coronary artery [**R.** 282].
    b. Right coronary artery.
    c. Venae cordis [**R.** 315]:
        1. Vena cordis magna [**R.** 316].
        2. Smaller veins of the heart.

Slit open, wash out and examine:

3. Right auricle (atrium dextrum) [**R.** 275].
    a. Inner surface.
    b. Openings of the Venae cavae.
    c. Auriculo-ventricular aperture.
    d. Coronary sinus and opening of Vena cordis magna.
    (e. Fossa ovalis [**R.** 277]).

Make a longitudinal incision through the ventral side of the pulmonary artery and the wall of the right ventricle to the apex of the heart. Wash out and examine:

4. Right ventricle [**R.** 277].
   - a. Wall of the ventricle. Note its thickness.
   - b. Inner surface.
   - c. Cordae tendineae and Columnae carneae.
   - d. Tricuspid valve.
   - e. Semilunar valves separating the pulmonary artery from the Conus arteriosus.
   - f. Left and right branches of the pulmonary artery.

Slit open the dorsal wall of the

5. Left auricle (atrium sinistrum) [**R.** 279], and examine:
   - a. Openings of the Pulmonary veins.
   - b. Auricular septum.
   - c. Auriculo-ventricular aperture.

Make a longitudinal incision through one side of the aorta and the wall of the left ventricle to the apex of the heart, and observe:

6. Left ventricle.
   - a. Wall. Its thickness compared with the right ventricle.
   - b. Inner surface.
   - c. Cordae tendineae.
   - d. Bicuspid, or mitral, valve.
   - e. Semilunar valves of the aorta.
   - f. Openings of the coronary arteries.

Draw a diagram of the heart and a cross section of the ventricles.

XVI. SALIVARY GLANDS

Remove the skin from one side of the head [Mivart, fig. 88].

Observe:

1. Masseter muscle, the large adductor muscle of the jaw [**R.** 108].
2. Two Lymph glands near the junction of the anterior and posterior facial veins.
3. Parotid gland, immediately below the ear [**R.** 223].
4. Parotid duct. (Steno's duct.) Trace it from the anterior border of the gland to its opening into the mouth opposite the molar tooth.

Remove the facial vein and lymph glands covering the submaxillary gland and clean its outer surface, and **observe:**

5. Submaxillary gland [**R.** 223].
6. Submaxillary duct (Wharton's duct). Its origin may be found by raising the gland and examining its inner surface.
7. Sublingual gland, parallel with Wharton's duct and apparently continuous with the submaxillary gland [**R.** 224].

Cut through and turn back the Digastric [**R.** 107], and the Mylohyoid [**R.** 114], muscles, and **trace** the ducts of both glands to the openings in the floor of the mouth.

Draw a diagram of the salivary glands.

XVII. ARTERIES OF THE HEAD AND NECK

Trace from the thorax into the head the

1. Right common carotid artery, and its branches [**R.** 283]:
    (a. Inferior thyroid, small, to the trachea.)
    (b. Superior thyroid [**R.** 284]).
    (c. Muscular branches.)

d. Occipital artery [**R.** 285], to the back of the skull.

2. Internal carotid artery [**R.** 285 & fig. 120 *c*], very small, arises in close connection with the occipital artery, and goes to the Auditory bulla [**R.** 32] with a vein. Compare homologous artery in man.
3. External carotid artery [**R.** 285], and its branches:
    - a. Lingual artery [**R.** 286], accompanied by the Hypoglossal nerve, XIIth Cranial [**R.** 383].
    - b. External maxillary artery, or Facial artery [**R.** 286].
    - (c. Posterior auricular [**R.** 287]).
    - (d. Superficial temporal.)
    - e. Internal maxillary artery [**R.** 287], to inner side of mandible.

Add these arteries to the diagram of the arterial system.

XVIII. MOUTH AND PHARYNX

Remove the masseter muscle and the posterior end of the zygomatic arch [**R.** 51]. Cut with the bone forceps through the mandible between the first premolar and the canine tooth. Disarticulate the mandible, cut through the cheek and floor of the mouth parallel to the inner border of the mandible, and remove the mandible with the parts attached to it.

Observe:

1. Mouth cavity (Cavum oris) [**R.** 221].
2. Mucous membrane lining the cavity.
3. Teeth and gums [**R.** 224].

4. Lips and cheeks.
5. Tongue [**R.** 226-229].
6. Palate: hard and soft.
7. Isthmus faucium, the passage leading into the pharynx.

Separate the hyoid bone from the auditory bulla and make a longitudinal incision through the lateral wall of the Pharynx, and **observe**:

8. Pharynx proper [**R.** 231], separated by the soft palate from the
9. Nasopharynx, and from the mouth by the
10. Pillars of the fauces, in which lie the
11. Tonsils [**R.** 230].
12. Opening into the Oesophagus.
13. Epiglottis and opening into the Larynx [**R.** 246-251].

Slit the soft palate lengthwise, and **observe**:

14. Openings into the Nasopharynx [**R.** 231-2]:
    a. Choanae, or Posterior Nares, from the nose.
    b. Eustachian tubes, from the ears. Are either of these structures represented in the Dogfish? In the Frog?

Turn the larynx, trachea, and lungs to one side, and without disturbing them further **trace** the

15. Oesophagus from the Pharynx to the Diaphragm. Slit open the oesophagus on one side, and notice character of the mucosa.

XIX. RESPIRATORY ORGANS

Cut off the end of the Snout, and **observe**:

1. Nasal cavity [**R.** 243].
2. Nasal septum.
3. Mucous membrane.

Pass a probe through the nasal cavity. Where does it emerge?

Insert a blow pipe into the trachea, and inflate the lungs.

(Where the blow pipe was inserted **cut** through the trachea and oesophagus, then separate the adjacent structures so as to remove in one piece the tongue, hyoid bone, larynx, and the anterior parts of the trachea and oesophagus. Carefully separate the larynx from the pharynx, and **study** the
4. Muscles of the Larynx [**R.** 249].
5. Cartilages of the Larynx [**R.** 247]).

Make a longitudinal incision through the larynx, and observe:
6. Cavity of the Larynx. How divided?
7. False vocal cords.
8. True Vocal cords [**R** 246].
9. Glottis, the opening between the Vocal cords.

Cut through the pulmonary ligaments, remove the trachea and lungs from the body, and **observe**:
10. The Trachea [**R** 251]:
    a. The tracheal cartilages, their shape.
    b. Lining of ciliated epithelium.
11. The Bronchi. How many? Their branches?
12. Lungs [**R.** 252]. How connected? How many lobes in each?

Make a diagram of the whole respiratory apparatus.

XX. THE SPINAL NERVES. [**R.** 383]

Carefully **separate** the muscles on the side of the neck, and **find** the 1st to 4th Cervical nerves. (Do they form a plexus?)

Tie and **cut** the Axillary vein or its branches. Leave the arteries intact for guides to aid in dissection.

Find: Phrenic nerve [**R.** 388]. Trace it to its origin, 5th to 8th Cervical nerves.
1st Thoracic nerve.
Brachial plexus [**R.** 386]. (Follow some of its branches.)

Draw a diagram of the plexus.

Find and **trace** both ways

1. An intercostal nerve, to be found near the posterior border of a rib.
2. 1st Lumbar nerve.

Remove both kidneys and any other organs that may be in the way. Near the Diaphragm on one side cut across the Iliopsoas and Psoas minor muscles [**R.** 139, 193, 398], lifting the posterior parts of these muscles.

Find:

1. 2nd, 3rd, and 4th Lumbar nerves.
2. Lumbar plexus [**R.** 395]. Trace its branches:
    a. Genitofemoral nerve [**R.** 396] from the 4th Lumbar.
    b. Lateral cutaneous nerve [**R.** 396] from 4th and 5th Lumbar.
    c. Femoral nerve [**R.** 397] from 5th and 6th Lumbar.
    d. Obturator nerve [**R.** 397] from 6th and 7th Lumbar.
    e. Lumbosacral trunk [**R.** 399] connecting 6th and 7th Lumbar nerves with the
3. Sacral plexus [**R.** 399].

Remove the skin from the lateral aspect of the thigh. Separate the Biceps femoris [**R.** 194] and the Caudofemoralis [**R.** 195] muscles near their proximal ends.

Cut across the Biceps femoris.

Find and **trace** both ways:

1. Ischiadicus, or Sciatic, Nerve [**R.** 400] arising from the Lumbosacral trunk and the 1st and 2nd Sacral nerves.
2. Pudendus nerve [**R.** 403] arising from the Sacral plexus, chiefly from the 2nd and 3rd Sacral nerves.

XXI. THE EYE. [**R.** 409]

Observe the

1. Eyelids.
2. Nictitating membrane.
3. Conjunctiva lining the eyelids and covering the exposed part of the
4. Eyeball.
5. Cornea, transparent, through which see the
6. Iris.
7. Pupil.

Cut away the eyelids and lateral wall of the orbit.

Observe:

8. Muscles of the orbit [**R.** 411]:
    a. Inferior oblique.
    b. External rectus.
    c. Retractor oculi (two of the four heads).
    d. Inferior rectus.
    e. Superior rectus.
    f. Superior oblique. Trace its origin.

Cut the tendon of the Superior oblique, and **find** the

    g. Internal rectus.

Pull the eyeball forward and **cut** the muscles and optic nerve as close to the bone as possible. Dissect the fat away from the eyeball, and

Observe: Insertions of the muscles.
Point of entrance of the optic nerve.

Make a diagram showing the relations of the eyeball and its muscles.

Remove the muscles and **make an incision** through the coats of the eye from the optic nerve to the centre of the cornea. Make another meridianal incision 90 degrees from the first and remove the quadrant.

(The other eye may be removed in a similar manner and after removal cut in two by an equatorial incision.)

Place the eye in a pan of water, and **study**:

1. Coats of the Eye [**R.** 413].
    - a. Sclerotic. What is its relation to the
        - *1* Cornea?
    - b. Choroid, pigmented,
        - *1.* Iris.
        - *2.* Ciliary body, with its fold.
    - c. Retina, its connection with the
        - *1.* Optic nerve at the
          Blind spot.
2. Contents of the Eye [**R.** 414]:
    - a. Crystalline lens, covered by its Capsule, attached to the Ciliary body by the Zonula ciliaris.
    - b. Aqueous humor, filling the anterior and posterior chambers of the eye, separated by the Iris and communicating through the Pupil.
    - c. Vitreous body, lying between the Lens and the Retina.

Make a diagram of the eye showing the relations of these parts.

XXII. THE SPINAL CORD. [R. 335]

With the subject in the prone position, **make an incision** through the skin from the base of the skull to the root of the tail. Reflect the skin for one or two inches on each side, and dissect away the muscles from the neural arches from the third cervical to the eighth thoracic vertebra. With the bone forceps remove the neural arch of one of the last cervical vertebrae, and find and isolate for a short distance the spinal nerve passing through the intervertebral foramen. Continue forward, removing the neural arches and isolating the nerves. The ganglion of the 2nd nerve will be found among the muscles dorsal to the Atlas and the Axis. Turn back the muscles and remove the arch of the Axis. Then continue the dissection posteriorly until the whole spinal cord and the roots of the nerves have been uncovered.

Observe:

1. Spinal cord.
2. Cervical and lumbar enlargements.
3. Filum terminale.
4. Meninges [**R.** 337]:
    a. Dura mater, slit it open and reflect it for an inch or two.
    (b. Arachnoid, pick off a little with the forceps.)
    c. Pia mater, closely adherent to the cord.

Reflect the pia mater, and study the

Fissures and grooves of the cord.

Cut through the cord where the meninges have been removed, and in the section **observe**:

1. Gray and white matter.

2. Fissures and grooves.

Study:

1. The Spinal nerves; how many?
2. Dorsal and ventral roots; which bear ganglia?
3. Manner of exit from the Vertebral canal.

(Follow one of the thoracic nerves to its

1. Branches:
    a. Ramus dorsalis,
    b. Ramus ventralis,
    c. Ramus communicans, with what does this connect?)

XXIII. THE BRAIN (Encephalon). [R. 339]

Before removing the brain **review** the anatomy of the Cranium [**R.** 21], with the aid of a divided skull, noting especially the

1. Occipital bone,
2. Parietal bones,
3. Frontal bones,
4. Temporal bones,
5. Zygomatic arch,
6. Tentorium,
7. Cribriform plate of the Ethmoid bone,
8. Sella turcica, and the
9. Foramina.

Skin the head (which may be separated from the body by severing the neck near the trunk), remove the zygomatic arch and the contents of the orbit on both sides, and cut away all muscles attached to the cranium. The lower jaw may also be removed. With the bone forceps make a small opening in the parietal bone *without* cutting the dura mater. With the seeker separate the dura from the bone, and then with the bone forceps chip away the bone until the whole dorsal surface of the brain is exposed as far back as the tentorium. Remove the arch of the atlas. Very carefully insert the point of the bone forceps into the foramen magnum and chip away the roof of the cranium, without injuring the dura mater, forward to the tentorium.

Observe:

1. Dorsal surface of the Brain,
    a. Its divisions:
        1. Hemispheres of the Cerebrum.
        2. Cerebellum.
        3. Medulla oblongata.
    b. Meninges of the brain [**R.** 368-9]:
        1. Dura mater, lining the skull and extending inward between the cerebral hemispheres, forming the Falx cerebri; also following the tentorium between the cerebrum and the cerebellum. **Cut** the dura on each side of the falx, reflect it, and observe the
        (*2.* Arachnoid).
        3. Pia mater.

Carefully **separate** the dura from the tentorium, **cut** through the latter on each side and remove it. Carefully dissect out the falx and tentorial dura, taking *great pains* not to tear away the Pineal body with it. Remove the dura from the dorsal surface of the cerebrum and cerebellum.

Continue to **chip** away one side of the cranium, removing the dura, until one side of the brain is fully exposed.

If the brain is soft, prepare a dish containing an alcohol-formaldehyde mixture and some absorbent cotton in the bottom. Holding the head sidewise over the dish, carefully separate the olfactory bulbs from the cribriform plate by cutting the fibres of the (I) Olfactory nerves. Then beginning at the foramen magnum, tilt the brain outward very gently with the handle of the scalpel, and with fine scissors **cut** in succession each Cranial nerve on one side of the brain as near its foramen as possible. Find and **cut** the two (VI) Abducens nerves attached to the anterior ventral side of the Medulla near the median line. Carefully dislodge the Hypophysis from the sella turcica. Then turn the brain over, cut the nerves in the same way from behind forward on the other side, and let the brain fall upon the cotton in the dish. Preserve the floor of the cranium for the study of the cranial nerves.

If the specimen has been **injected**, observe the
Blood vessels of the brain [**R.** 291].

Remove the remaining parts of the dura mater, cutting carefully the adhesions around the nerves. Be careful not to disturb the pia mater on the dorsal side of the medulla, elsewhere it may be removed where not adherent to the brain.

Study:

1. Dorsal and lateral Surfaces of the Brain [**R.** 340 and 358]:
    - a. Cerebrum;
        - *1.* Hemispheres, separated by the
        - *2.* Sagittal fissure.
        - *3.* Gyri (ridges).
        - *4.* Sulci (grooves).
        - *5.* Fissure of Sylvius [**R.** 358], separating the
        - *6.* Frontal lobe from the

        - *7.* Temporal lobe, united posteriorly in the
        - *8.* Occipital lobe.
        - *9.* Olfactory bulbs, at the anterior ends of the Hemispheres.
    - b. Cerebellum [**R.** 348];
        - *1.* Gyri and Sulci.
        - *2.* Vermis, median.
        - *3.* Hemispheres, lateral.
    - c. Medulla oblongata;
        - *1.* Dorsal sulcus.
        - *2.* Corpus restiforme, on each side.

Draw the dorsal surface of the brain.

Study the ventral surface [**R.** 342]:

1. Medulla oblongata;
    - a. Ventral fissure.
    - b. Pyramidal tracts.
2. Pons.
3. Pedunculi cerebri (Crura cerebri).
4. Hypophysis.
5. Optic chiasma [**R.** 355], where the Optic nerves pass into the Optic tracts.
6. Olfactory tracts, a band of white matter on each side connecting the
7. Olfactory bulbs with the
8. Pyriform lobes. These with 6 and 7 are important parts of the
9. Rhinencephalon, which is bounded laterally by the
10. Sulcus rhinalis [**R.** 360 and 361].
11. Roots of the Cranial nerves [**R.** 369]:
    - I. Olfactory, really a multitude of small nerves that arise from the Olfactory bulbs and pass out through the cribriform plate.

II. Optic, from the Chiasma in front of the Hypophysis.
III. Oculomotor, from near the ventral median line just in front of the Pons.
IV. Trochlearis, from between the Cerebral hemisphere and the Cerebellum.
V. Trigeminal, two roots, from the posterior edge of the Pons. The large root extends forward to the Gasserian ganglion and divides into three branches. Find these, probably in the floor of the cranium.
VI. Abducens, ventral side of the Medulla near the Pons.
VII. Facial, behind V [**R.** 347, 375].
VIII. Acoustic, behind VII [**R.** 377-8].
IX. Glossopharyngeal [**R.** 347, 378].
X. Vagus [**R.** 346, 378]. **Take care** not to injure the small roots of these nerves.
XI. Spinal accessory [**R.** 346, 382].
XII. Hypoglossal [**R.** 346, 383].

Draw the ventral surface showing these features.

With a very sharp scalpel or razor **make** a median longitudinal **incision** through the Cerebellum only, and carefully slice away the *left* half of the Cerebellum by a series of horizontal sections until the cavity beneath is exposed. With fine scissors cut the Velum medullare posterius [**R.** 349] lengthwise and remove the left half. (For the human brain see Linebach, *Anat. Rec.* Vol. 9, pp. 387-391.)

Observe:

1. Fourth Ventricle [**R.** 349]:
    a. Its floor, Fossa rhomboidea.
2. Cut surface of the Cerebellum.

        - a. White and Gray matter; the former is called the Arbor vitae.
    - 3. Cut surfaces of the Corpus restiforme, Brachium pontis, and Brachium conjunctivum [**R.** 349].
    - 4. Their connections with the Medulla, the Pons, and the Corpora quadrigemina.

Carefully **slice away** the top of the *left* Cerebral hemisphere only, by a series of thin horizontal sections nearly to the bottom of the Sagittal fissure, and expose the

1. Corpus callosum [**R.** 357, 363].

Make a longitudinal **incision** through the Corpus callosum and remove the *left* half, and

Expose the

2. Septum pellucidum, connecting the corpus callosum with the
3. Fornix.
4. Left Lateral ventricle [**R.** 362].
5. Choroid plexus of the Lateral ventricle.

By **cutting away** a little at a time of the brain substance, expose

1. Anterior and lateral Horns of the Lateral ventricle.
2. Corpus striatum [**R.** 367].
3. Hippocampus [**R.** 365].
4. Posterior end of the Fornix.
5. Foramen of Monro [**R.** 363].
6. Anterior commissure [**R.** 365 and 357].

Remove the occipital and parietal portions of the *left* cerebral hemisphere, and expose the

1. Roof of the Third ventricle,
    - a. Pineal body.
    - b. Choroid plexus.

2. Midbrain [**R.** 351],
    a. Corpora quadrigemina.

Remove the Choroid plexus, and observe the

1. Third ventricle, bounded on the sides by the
2. Thalami [**R.** 353].

Place the brain ventral side down upon a dissecting board. Insert a very sharp scalpel or razor, wet with alcohol, between the olfactory bulbs and with its point touching the board draw it backward so as to make an exactly median longitudinal *section* of the brain.

Study the inner surface of the *right* half of the brain, identifying:

1. Structures previously seen.
2. Gyri and Sulci on the inner surface of the cerebral hemisphere [**R.** 361].
3. Lamina terminalis [**R.** 352 and 357].
4. Infundibulum [**R.** 355].
5. Mammillary body [**R.** 356].
6. Posterior commissure [**R.** 355].
7. Aqueductus cerebri (Aqueductus Sylvii) [**R.** 350].

Identify the five Principal Subdivisions of the brain, and make a list showing the cavity enclosed by each one and the structures which form its roof, floor, and sides [**R.** 343]. Beginning at the *posterior* end these are:

1. Myelencephalon, from the first pair of cervical nerves to the posterior edge of the pons.
2. Metencephalon, from the posterior edge of the pons to the velum medullare anterius.
3. Mesencephalon, from the velum medullare anterius and the anterior edge of the pons to a

line connecting the posterior commissure with the posterior margin of the mammillary bodies.

4. Diencephalon, from the anterior border of the mesencephalon to the depression in front of the optic chiasma, the boundary between the thalamus and the corpus striatum, and the choroid plexus in front of the pineal body.
5. Telencephalon, from the anterior border of the diencephalon to the tips of the olfactory bulbs, including both hemispheres.

Make a drawing of the median section of the brain.

Cut the right half of the brain into transverse sections about a quarter of an inch thick.

Identify the structures in each section, and observe the arrangement of the

White and Gray matter.

Draw three typical sections.

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